Using the MATLAB Hurricane Data and Plotting Package

The Zip file *tcdata.zip* contains five data (.mat) files, a MATLAB script (*tcplot.m*) and a directory of map plotting files*, m_map*, together with a subdirectory. A much larger file, *highres_data.zip*, contains high resolution coastline and topographic/bathymetric data that supplements the lower resolution files contained in *tcdata.zip*.

The directory *m_map* and all of its contents **must** be placed in the MATLAB path so that they can be accessed by tcplot. This package is also obtainable free from its author, Rich Pawlowicz, who can be contacted at *rich@ocgy.ubc.ca* . Documentation is available from the file *map.html* in the *m_map* directory.

Please note that I have included in the *m_map* subdirectory *private* low and intermediate resolution coastline files and a low resolution topographic/bathymetric file. You may obtain high resolution coastline and topographic files by downloading *highres_data.zip* and unpacking the files into the subdirectory *m_map/private*. An even higher resolution coastline file may be obtained by referring to the section on GSHHS coastline data in the *m_map* user's guide (see *map.html*). You can also obtain higher resolution topography and bathymetry than is included with this package.

Geographical boundaries may also be included as an option. For the latest geographic data, see *map.html*. Boundaries that are current as of early 2005 may be obtained by downloading the file *states.zip* and storing the extracted content in a subdirectory named 'states'.

The script *tcplot.m* plots tropical cyclone tracks (optionally color coded for intensity) on a map background, by year and storm number. The basin is specified as an input option. Also see the script itself for many options on plotting the tracks.

Running tcplot.m or simply loading one of the data files (*bb*tracks.mat, where *bb* stands for the basin) gives you access to all the tropical cyclone tracks up through a recent year. The Atlantic and eastern North Pacific files were obtained from NOAA's Tropical Prediction Center, and all the other data from the U.S. Navy's Joint Typhoon Warning Center. Note that the southern hemisphere season begins in July and runs through June and is labeled by the second year, so that, for example, a November 1998 storm will appear in the 1999 storm file.

Loading the .nc files yields seven two dimensional arrays and four one-dimensional vectors. The arrays have dimensions N X M, where N is the total number of storms in the data set. The second dimension represents the six-hour datum for the N^{th} storm; for example, daym(982,42) represents the day of the month of storm 982 at the 42nd six-hour record. Note that all the arrays are padded with zeros from the last record to M.
The arrays contain the month, day of the month, hour (GMT), latitude (degrees, with negative indicating the southern hemisphere), longitude (0-360 degrees), maximum wind speed (m/s), and central surface pressure (hPa) for each record. Missing data are indicated by zeros.

The four vectors are each of length N and contain the year of the storm file, the basin, the storm name, and the storm number within the year. So, for example, *nsi(982)* might be 4, meaning that that storm was the 4th of the year in which it occurred.

See the script *tcplot.m* for an example of how the data files can be used.

Modifications to NHC and JTWC best track wind speeds (as of 2/2006)

The wind speeds reported in both the NHC (for Atlantic and eastern North Pacific) and JTWC (all other basins) data sets are regarded as 1-minute averaged sustained winds at an altitude of 10 meters. But methods of estimating the maximum 1-minute sustained surface wind have evolved over the years, introducing biases and spurious trends in the data. In an effort to minimize these, we have introduced wind speed-dependent corrections to the wind speed estimates, as follows.

Methods of estimating surface sustained wind from reconnaissance aircraft have varied since missions began in the later 1940s. Initially, wind was estimated from visual observations of the surface, but were later supplemented or replaced by dropwindsonde observations. Until dropwindsondes and Doppler radar observations became prevalent, heavy reliance was replaced on observations or estimates of minimum surface pressure. MSLP was converted to surface sustained wind using formulae that evolved in time, based on new data.

For the Atlantic, Landsea (*Mon. Wea. Rev.*, 1993) documented a significant change in the wind speed-MSLP around 1970. We fit a sine curve to the data in his Table 5 and used this to correct pre-1970 wind speeds according to

$$v' = v\left[1 - 0.14\sin\left(\frac{\pi(v-45)}{75}\right)\right],$$

where v' is the adjusted velocity and v is the original velocity, both in knots. This adjustment is applied ONLY for winds speeds between 45 and 120 knots.

In the western North Pacific, JTWC updated its wind speed-MSLP around 1973, according to their annual tropical cyclone reports. We adjusted pre-1973 winds to reflect the updated speed-MSLP relation. We first define and adjusted wind speed:

$$v' = 0.1884v^{1.288}$$

where the original and adjusted wind speeds are in knots. We then define a final adjusted wind speed at as weighted combination of this and the original wind speed:

$$v'' = \sigma v + (1-\sigma)v',$$

where $\sigma = 0.4$ prior to 1967, and $\sigma = 0.8$ in the years 1968-1972, inclusive.

Unlike the Atlantic adjustment, this significantly affects the surface sustained wind over the whole range of reported wind speeds. We also applied this correction to the southern hemisphere and Northern Indian Ocean, though there are so few pre-1974 wind reports in those data sets, that this is not very consequential.